dielectric materials for the low-refractive-index layers **12**L include silicon dioxide (SiO_2) and magnesium fluoride (MgF_2).

[**0035**] Each layer of the optical thin film **12** is formed so as to have the convex portions **12**A having the same shape as that of the convex portions **11**A of the substrate **11**. Each thickness of the layers of the optical thin film **12** is set according to a simulation based on a matrix method so that, for example, the optical thin film **12** reflects light in wavelength bands of the three primary colors, red, green, and blue, and transmits other light in at least a visible wavelength band. Specifically, the optical thin film **12** reflects red light having a wavelength of about 630 nm, green light having a wavelength of about 540 nm, and blue light having a wavelength of about 460 nm and transmits other light in at least a visible wavelength band. For example, each thickness of the layers is set in the range of 80 to 200 nm.

[**0036**] When light in the three primary color wavelength bands perpendicularly enter the optical thin film **12**, the rays of the light have incident angles with respect to the surface of the optical thin film **12**, at the convex portions **12**A. Accordingly, a predetermined percentage of the light is diffused at angles twice the incident angles. More specifically, the maximum angle of the diffuse reflection of the rays depends on the angle θ formed by the straight line connecting a boundary point **11***a* with the center of the sphere defined by the spherical surface of the corresponding convex portion **11**A and the normal to the surface of the top of the convex portion **11**A, and it is **20**, as shown in **FIG. 3**. Thus, a predetermined percentage of the light in the tree primary color wavelength bands is diffuse-reflected at reflection angles up to 2θ, and, consequently, the viewing angle of the screen is increased. The boundary point **11***a*, incidentally, is between the convex portions **11**A and flat surfaces of the substrate **11**.

[**0037**] The protective film **13** protects the optical thin film **12**. The protective film **13** is also formed in the same shape as that of the surface of the optical thin film **12**. However, the surface of the protective film **13** may be flat.

[**0038**] A method for manufacturing the projection screen **10** will now be described. The substrate **11** is prepared from a macromolecular material containing a black paint. The surface of the substrate **11** is subjected to, for example, embossing to form the plurality of convex portions **11**A. The shape, curvature radius r, arrangement, area ratio, surface properties, and the like of the convex portions **11**A are designed according to, for example, an optical simulation. Since the convex portions **11**A allow light reflected from the optical thin film **12** to diffuse at a predetermined percentage, the range of diffuse reflection angle from the optical thin film **12** is appropriately set according to the design of the convex portions **11**A. The regions of the surface of the substrate **11** between the convex portions **11**A, incidentally, are flat.

[**0039**] The optical thin film **12** is deposited on the substrate **11** by, for example, sputtering. In this instance, the optical thin film **12** is formed so as to have convex portions **12**A having the same shape as that of the convex portions **11**A of the substrate **11**. Also, the optical thin film **12** is a dielectric laminate formed by alternately laminating dielectric high-refractive-index layers **12**H and dielectric low-refractive-index layers **12**L having a refractive index lower than that of the high-refractive-index layers **12**H. The thicknesses of the layers of the optical thin film **12** are set according to a simulation based on a matrix method so that, for example, the optical thin film **12** reflects light in wavelength bands of the three primary colors and transmits other light in at least a visible wavelength band. Finally, the protective film **13** is formed on the optical thin film **12**. Thus, the projection screen **10** shown in **FIG. 1** is completed.

[**0040**] Since, in the embodiment, the convex portions **11**A of the substrate **11** is designed so as to allow light reflected from the optical thin film **12** to diffuse at a predetermined percentage, the optical thin film **12** overlying the substrate **11** can be provided with convex portions **12**A having the same shape as that of the convex portions **11**A of the substrate **11**. Thus, the resulting screen has a simple structure.

[**0041**] The simulation based on the matrix method used for designing the optical thin film **12** will now be described. In this simulation, a dielectric laminate formed on a substrate is used as a model. If light enters the surface of this dielectric laminate at an angle from a light source, the light is multiple-reflected at the interfaces between the layers of the dielectric laminate. The rays of the multiple-reflected light interfere with each other depending on the wavelength of the light from the light source and the thickness and refractive index of the layers.

[**0042**] The matrix method is applied to this model of the dielectric laminate. Specifically, a matrix operation is performed so that optical lows, such as Maxwell's equations and Snell's law, satisfy boundary conditions of the layers of the dielectric laminate, using parameters, such as the wavelength of light, the thickness and refractive index of the substrate, the thickness and refractive index of the layers of the dielectric laminate, and the angle of incident light. Thus, optical properties of the dielectric laminate, such as transmittance and reflectance, are derived. According the derived optical properties, the dielectric laminate is designed.

[**0043**] The projection screen **10** is used for, for example, a front projector **20** using a GLV. **FIG. 4** is a schematic illustration of the projector **20**. The projector **20** includes a laser oscillator unit **21** for emitting narrow-band light beams in wavelength bands of the three primary colors. The laser oscillator unit **21** includes, for example, a laser oscillator **21**R for emitting a red light beam having a wavelength of 642 nm, a laser oscillator **21**G for emitting a green light beam having a wavelength of 532 nm, and a laser oscillator **21**B for emitting a blue light beam having a wavelength of 457 nm.

[**0044**] The projector **20** also includes an optical system comprising a collimator lens unit **22**, a cylindrical lens **23**, a GLV **24**, volume hologram elements **25**, a galvanometer mirror **26**, and a projection lens **27**. The collimator lens unit **22** is essentially composed of a collimator lens **22**R for red light, a collimator lens **22**G for green light, and a collimator lens **22**B for blue light. The GLV **24** includes a ribbon line **24**R for red light, a ribbon line **24**G for green light, and a ribbon line **24**B for blue light. The volume hologram elements **25** are a first volume hologram element **25***a* and a second volume hologram element **25***b*.

[**0045**] The red light beam emitted from the red laser oscillator **21**R, the green light beam emitted from the green laser oscillator **21**G, and the blue light beam emitted from